

Please amend the present application as follows:

Claims

The following is a copy of Applicant's claims that identifies language being added with underlining ("____") and language being deleted with strikethrough ("_____") or brackets ("[[]])", as is applicable:

1. (Withdrawn) A fuel cell, comprising:
a membrane comprising a material selected from organic conducting materials, inorganic conducting materials, and combinations thereof, wherein the membrane has a thickness of about 0.01 to 10 μm , and wherein the membrane has an area resistivity of about 0.1 to 1000 ohms cm^2 .
2. (Withdrawn) The fuel cell of claim 1, wherein the membrane has a thickness of about 0.1 to 5 μm .
3. (Withdrawn) The fuel cell of claim 1, wherein the membrane has a thickness of about 0.1 to 2 μm .
4. (Withdrawn) The fuel cell of claim 1, wherein the membrane has an area resistivity of about 1 to 100 ohms cm^2 .
5. (Withdrawn) The fuel cell of claim 1, wherein the membrane has an area resistivity of about 1 to 10 ohms cm^2 .

6. (Withdrawn) The fuel cell of claim 1, wherein the material is selected from silicon dioxide, doped silicon dioxide, silicon nitride, doped silicon nitride, silicon oxynitride, doped silicon oxynitride, metal oxides, doped metal oxides, metal nitrides, doped metal nitrides, metal oxynitrides, doped metal oxynitrides, and combinations thereof.

7. (Withdrawn) The fuel cell of claim 6, wherein the doped silicon dioxide is selected from phosphorous doped silicon dioxide, boron doped silicon dioxide, and combinations thereof.

8. (Withdrawn) The fuel cell of claim 1, further comprising a catalyst disposed on a first side of the membrane, wherein the catalyst is selected from platinum, platinum/ruthenium, nickel, tellurium, titanium, alloys of each, and combinations thereof.

9. (Withdrawn) The fuel cell of claim 8, further comprising a polymer layer on a second side of the membrane, wherein the polymer layer has a catalyst disposed on the side opposite the membrane.

10. (Withdrawn) The fuel cell of claim 1, wherein the membrane has a thickness of about 0.1 to 2 μm and wherein the membrane has an area resistivity of about 1 to 10 ohms cm^2 .

11. (Previously presented) A micro-fuel cell, comprising:

a substrate having a top surface;

anode current collectors disposed on the top surface of the substrate;

a membrane provided above the top surface of the substrate and contacting the anode current collectors;

hollow channels that are positioned above the top surface of the substrate and that pass through the membrane, each channel being defined by the top surface of the substrate and inner surfaces of the membrane;

a first porous catalyst layer disposed on the inner surfaces of the membrane;

and

a cathode current collector provided above the membrane.

12. (Canceled)

13. (Previously presented) The micro-fuel cell of claim 11, further comprising additional catalyst layers disposed on the top surface of the substrate within the channels, wherein there is an electrically conductive path between the additional catalyst layers, the first porous catalyst layer, and the anode current collector.

14. (Canceled)

15. (Previously presented) The micro-fuel cell of claim 11, further comprising a second porous catalyst layer disposed on top of the membrane, wherein there is an electrically conductive path between the cathode current collector and the second porous catalyst layer.

16. (Previously presented) The micro-fuel cell of claim 11, further comprising a polymer layer disposed on top of the side of the membrane and a second porous catalyst layer disposed on top of the polymer layer, wherein the cathode current collector is disposed on top of the second porous catalyst layer.

17. (Original) The micro-fuel cell of claim 16, wherein the polymer layer is selected from perfluorosulfonic acid/polytetrafluoroethylene copolymer, polyphenylene sulfonic acid, modified polyimide, and combinations thereof.

18. (Previously presented) The micro-fuel cell of claim 11, wherein the first catalyst layer includes catalysts selected from platinum, platinum/ruthenium, nickel, tellurium, titanium, alloys thereof, and combinations thereof.

19. (Previously presented) The micro-fuel cell of claim 11, wherein the membrane has a thickness of about 0.1 to 5 μm and wherein the membrane has an area resistivity of about 1 to 100 ohms cm^2 .

20. (Previously presented) A method for fabricating a micro-fuel cell, comprising:

providing a substrate having a top surface;

disposing anode current collectors on the top surface of the substrate;

disposing a sacrificial polymer material on the top surface of the substrate and the anode current collectors;

removing the portions of the sacrificial material disposed on the anode current collectors to form sacrificial polymer material portions that remain on the top surface of the substrate;

disposing a first porous catalyst layer on top of the sacrificial polymer material portions;

disposing a layer of a membrane material on top of the first porous catalyst layer and the anode current collectors to form a membrane; and

removing the sacrificial polymer material portions to form hollow channels that are positioned above the top surface of the substrate and that pass through the membrane, the channels being defined by the top surface of the substrate and the membrane.

21. (Previously presented) The method of claim 20, further comprising:

disposing a second porous catalyst layer on the membrane; and

disposing a cathode current collector on the second porous catalyst layer.

22. (Previously presented) The method of claim 20, further comprising:
disposing a polymer layer on the membrane;
disposing a second porous catalyst layer on the polymer layer; and
disposing a cathode current collector on the second porous catalyst layer.

23. (Original) The method of claim 20, wherein the polymer layer is selected from perfluorosulfonic acid/polytetrafluoroethylene copolymer, polyphenylene sulfonic acid, modified polyimide, and combinations thereof.

24. (Previously presented) The method of claim 20, further comprising:
providing additional catalyst layers on the top surface of substrate before
disposing a sacrificial polymer layer, wherein the additional catalyst layers are disposed
between the sacrificial polymer material portions and the top surface of the substrate.

25. (Previously presented) The method of claim 20, wherein the sacrificial polymer material is selected from polyimides, polynorbornenes, epoxides, polyarylenes ethers, polyarylenes, inorganic glasses, and combinations thereof.

26. (Previously presented) A method for fabricating a micro-fuel cell, comprising:

providing a substrate having a top surface;

disposing alternating anode current collectors and catalyst layers on the top surface of the substrate;

disposing a sacrificial polymer material on top of the anode current collectors and the catalyst layers;

removing portions of the sacrificial polymer material disposed on the anode current collectors to form sacrificial polymer material portions disposed on the catalyst layers;

disposing a layer of a membrane material onto the sacrificial polymer material portions and the anode current collectors to form a membrane; and

removing the sacrificial material portions to form hollow channels that are positioned above the top surface of the substrate and that pass through the membrane, the channels being defined by the top surface of the substrate and the membrane.

27. (Previously presented) The method of claim 26, further comprising:

disposing a porous catalyst layer on the sacrificial polymer material portions prior to disposing the membrane material.

28. (Previously presented) The method of claim 26, further comprising:

disposing a porous catalyst layer on the membrane; and

disposing a cathode current collector on the porous catalyst layer.

29. (Previously presented) The method of claim 26, further comprising:
disposing a polymer layer on the membrane;
disposing a porous catalyst layer on the polymer layer; and
disposing a cathode current collector on the porous catalyst layer.

30. (Previously presented) The method of claim 29, wherein the polymer layer is selected from perfluorosulfonic acid/polytetrafluoroethylene copolymer, polyphenylene sulfonic acid, modified polyimide, and combinations thereof.